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EDITORIAL.

THE report of the Departmental Committee on coroners, although chiefly containing recommendations which will affect and please legal persons who were dissatisfied with present arrangements, offers at least one paragraph which will be most welcome to medical men generally and to our readers in particular. This runs "we consider that coroners should be informed of all deaths under or in consequence of an anæsthetic, or during an operation; but that there should be an express statutory provision that, where an anæsthetic has been administered or an operation performed with reasonable care, a death which results should not be regarded, by reason simply of the fact that an anæsthetic has been administered or an operation performed, as a violent or an unnatural death. It should, however, be provided that the coroner, before deciding not to hold an inquest because he is satisfied that reasonable care was shown, should have regard to any views expressed by the relatives of the deceased." If this becomes law at least half of the grievance which anæsthetists have felt against present arrangements will be removed. This grievance was in part resentment against those inquests which were obviously unnecessary but which the coroner thought himself obliged to hold and which received unchecked publicity. This publicity often gave to minds of an indiscriminating public an impression almost of guilty conduct on the part of an anæsthetist or surgeon. Moreover, they were apt to put

unjustified fears into the imagination of susceptible persons who read them and who happened themselves to be about to undergo operation.

By doing away with these inquests the publicity will be done away with too. This is a capital reform, and if, as we believe is true, it was facilitated by the evidence put before the Committee by representatives of the Association of Anæsthetists, then that Association may pride itself on once more having been of signal service to the body of its members and to anæsthetists in general. Moreover, we believe influence of the Association's evidence can be detected in another portion of the Committee's findings. This is the statement: "We have been impressed by the need for scientific enquiries into the causes of deaths due to anæsthetics, but the arrangements to be made for investigating these deaths and for collating centrally the results of inquiries at local hospitals, do not come within our terms of reference. We believe, however, that the recommendations under this head will facilitate the conduct of scientific inquiries in these cases." The recommendations referred to are these: "That steps should be taken administratively to ensure that the authorities of hospitals and nursing homes report to the coroner any deaths under anæsthetics or in the course of an operation, with such information about the circumstances of the case as the coroner may wish in this class of case. On receipt of this information the primary question to which the coroner should address himself is whether the circumstances are such that for his purposes he desires a post-mortem examination. Such an examination would be made at public expense, and normally the coroner might be expected to choose a pathologist outside the hospital in question for the examination. If the coroner does not require a post-mortem examination to be performed, he should inform the hospital authorities without delay in order that the hospital may make arrangements for an examination for scientific purposes if such is thought desirable." It is clear that the Committee thoroughly understood and appreciated the second chief grievance of anæsthetists, which was that for the purposes of increasing scientific knowledge or diminishing anæsthetic fatalities the present arrangements are futile. The Committee's enlightened views in this

respect are also manifest in their statement that post-mortem examinations ordered by coroners, save in exceptional cases, should be made by pathologists on a list to be kept by the Home Office under the advice of an expert Advisory Committee. If all the recommendations of Lord Wright's Committee are accepted we foresee in connexion with anæsthetics one possible source of error. This arises from the provision that coroners in future should be lawyers. When they are medically qualified, too, there should be no loophole, but we imagine the great majority will be without any special medical knowledge. For them it may be difficult to decide rightly when an inquiry should be held into an "anæsthetic" death, and we would have liked to see some provision for expert aid to the coroner in making his decision in these instances.

ANÆSTHETICS IN THORACIC SURGERY WITH SPECIAL REFERENCE TO LOBECTOMY

By I. W. MAGILL, M.D.

(From a paper read before the Section of Anæsthetics, Royal Society of Medicine.)

DURING the last six years thoracic surgery has continued to advance. Some new anæsthetics have come into prominence, and anæsthetic technique has been developed. In 1930 I was able to report only four anæsthetics[1] for lobectomy, in a period of eight years. Today the number has increased to 128. This number includes 46 cases, anæsthetized by my colleague Dr. Machray, and represents the work of one surgical team only. The inclusion of the figures of other workers would provide even more striking evidence that lobectomy, which was formerly regarded as a rare operation even in a chest hospital, now appears on the operating list with considerable frequency. Aided and abetted by optimistic surgical reports, such as those of Tudor Edwards and Price Thomas[2] and by increasing confidence in anæsthetic technique, it is not unreasonable to forecast that lobectomy will appear with increasing frequency on the operation lists of general hospitals as well as of those devoted to surgery of the chest alone.

It has always been my conviction that the results of scientific research in any subject should be open for discussion notwithstanding the absence of finality in them, and as far as anæsthesia is concerned, the Section of Anæsthetics of the Royal Society of Medicine is the only body in this country which affords such an opportunity.

It is for this reason then, that I have undertaken to open the discussion on this subject, and I should like to take up the story at the point where we left it six years ago. If thoracic surgery is likely to become routine in the general hospital, it is well that anæsthetists, who may be called upon to share the responsibility in this branch of work, should benefit from the experience (mistakes included) of

those who have been engaged regularly in this special type of anæsthesia for some years.

This preface also requires the addition of an apology. The presentation of a paper on a subject of this kind should be supported by case records, drawn up with meticulous care and accuracy. Blood-pressure charts are of particular value. I am sadly deficient in this respect, for like Portia "I had rather teach twenty what 'twere good to do, than be one of the twenty to follow mine own teaching." So to those of you who have the time and opportunity, I would say, keep a complete record of each anæsthetic given for a major thoracic operation. Such records will be valuable, not only to yourself but to posterity.

Anyhow the whole position will bear revision and some recapitulation, not only now, but again at no very distant date; with wider experience, more valuable conclusions should be forthcoming. For my own part, I am glad of this opportunity to correct some of my early impressions in the light of further experience.

The importance of respiration to life is a matter of common knowledge. During surgical anæsthesia, whatever the nature of the operation, the maintenance of free respiration is recognized as a first principle. It is a natural conclusion then, that the presence of disease in the organs involved in respiration, places many thoracic operations in a special category from the standpoint of anæsthesia. It is freely admitted, I think, that anæsthesia has already contributed much to the progress of thoracic surgery. Nevertheless, from the diversity of anæsthetic agents and of methods employed in various clinics, it is apparent that opinion is not unanimous as to which technique is best. This lack of unanimity is evidence in itself that all methods at present in use are as yet on trial.

In any case, before making a choice, certain factors which are common to many thoracic operations require careful consideration.

1. *Condition of the Patient.*

Operation is usually decided upon when medical measures alone have failed to arrest the disease. Hence many of these patients are more or less chronic invalids.

They have been subject to toxæmia for a considerable time. Frequently they are exhausted by the ever-present necessity to cough up sputum and prevent its accumulation. Vital capacity is diminished, the lung area available for oxygen absorption being thus reduced. Dyspnœa occurs on slight exertion, and may be present even during rest. Clearly they cannot be regarded as good subjects for general anæsthesia and inhalation anæsthesia especially.

2. *The Requirements of the Operation.*

To enable the surgeon to obtain acess to the operation area, in most cases the patient is required to lie in the lateral position. A sandbag or air cushion is placed between the axilla and the table. This brings the affected side into prominence and also assists to some extent in maintaining freedom of movement of the lower ribs. Nevertheless the necessary position is to some extent a handicap to free respiratory excursion. This is especially true when the lung which is uppermost has been practically thrown out of function by pneumothorax and by forcible separation of the ribs. In this position, also, sputum from the affected side may be expelled or squeezed into a position in the trachea, providing conditions favourable for aspiration into the opposite lung. Aspiration is liable to occur in this way during collapse of cavities by thoracoplasty, or during manipulation of the affected lung in lobectomy. The possibility of such an occurrence must be prevented by suitable posture, by maintenance of an active cough reflex or by removal of secretions by endotracheal or endobronchial suction. I hope to show later that the transfer of secretion from one side to the other cannot be prevented simply by positive pressure, except in the presence of a bronchial fistula. However, there is one advantage in our favour. Muscular relaxation to the degree required for abdominal surgery is not essential. Hence deep anæsthesia is fortunately unnecessary.

Requirements of the Anæsthetic

From the foregoing considerations it is apparent that the anæsthetic and the method of administration must fulfil certain requirements.

1. The agent or combination of agents should cause no irritation or damage immediate or remote to the lungs.

2. Agents which are liable to cause post-operative acidosis should be avoided as far as possible.

3. When general anæsthesia is selected, recovery should be rapid in order that sputum may be actively coughed up when the operation is over.

4. The cough reflex should be active throughout unless provision is made for removal of secretions by suction while the operation is in progress.

5. Positive pressure should be available to assist pulmonary ventilation when required.

Preparation of the Patient.

Thoracic operations are not usually emergencies, so that there is ample time for preparation. Every effort should be made to present the patient for operation in a condition of maximum fitness. Abundance of fluid and glucose during the preceding 24 hours does much to strengthen reserves. When profuse expectoration is a feature of the case, the patient is placed for a time, before coming to the theatre, in the position which enables him best to clear his lungs of sputum. This postural drainage is a definite help.

When the thorax is to be opened in the presence of a free pleura, I always feel happier when pneumothorax has been carried out a few days beforehand. I am certain that this is a more rational procedure than the sudden production of pneumothorax in the early stage of a severe operation.

Preliminary Medication.

The administration of sedative drugs before these operations requires special consideration.

A patient who produces sputum in any considerable quantity requires the protection of active cough reflexes to enable him to avoid accumulation. Should the cough reflex be impaired during anæsthesia the onus of evacuating sputum falls upon the anæsthetist. As already pointed out, this can be accomplished by suction, but an active cough reflex is absolutely essential when this mechanical protection is withdrawn. Clearly then the action of any sedative used in thoracic surgery should be of short duration.

The choice of drugs depends to some extent on the nature of the subsequent anæsthesia. When local analgesia or spinal analgesia is to follow, the sedative should not be given in doses sufficient to abolish consciousness completely. Well-meant efforts in this direction frequently destroy all power of co-operation, with the result that the patient is both restless and uncontrollable. Omnopon and scopolamine, with a small dose of a suitable barbiturate, form a useful sedative combination.

On the other hand, when general anæsthesia is decided upon, the co-operation of the patient during the operation is most essential. Hence it is possible before general anæsthesia to extend to the patient the popular benefit of basal narcosis, again with the important proviso that only short-acting drugs be employed for the purpose. A practical method of carrying this into effect is to administer omnopon and scopolamine three-quarters of an hour before operation and obtain basal narcosis with a minimal dose of a short-acting barbiturate, such as evipan, given intravenously immediately before induction. Experience proves that basal narcosis produced with such a combination causes no material interference with the cough reflex, and detoxication of the evipan is complete when the operation is terminated

For this purpose no doubt some of the newer barbiturates will prove equally useful.

Avertin.

As regards avertin, the advantages of this drug in other branches of surgery are well known. Generally speaking, however, the action of avertin is too long to be safe in the majority of thoracic operations, especially when the quantity of sputum is considerable. It may be used in children who detoxicate the drug rapidly, or in certain patients in whom the metabolic rate is high. In any case avertin requires careful administration, since the dose reckoned on body weight may not be required in full.

Methods of Anæsthesia Available.

These may be considered under the following heads.

I. *Local Analgesia.*

The *advantages* of local and regional analgesia are:—

1. No irritation or damage to the lungs.
2. No impairment of the cough reflex.
3. No post-operative vomiting or interference with metabolism.
4. Less bleeding than under general anæsthesia.

The *disadvantages* are :-

1. The length of time required for extensive injections.
2. Possibility of delayed healing or necrosis in a widely injected area.
3. Toxic effects of the drug.
4. The performance of the operation on a conscious patient.

II. *Spinal Analgesia.*

Spinal analgesia may be conviently discussed at this juncture.

My interest in spinal analgesia in chest surgery was stimulated by a paper by Shields[3] of Toronto and by a personal communication from Dr. F.van Snell who had the opportunity of observing the work at Shenstone's clinic. Shields has published a further report on the subject in a recent issue of *Current Researches in Analgesia and Anæsthesia.*[4]

I feel sure that many of us when using a high spinal in abdominal surgery have been surprised, if not actually alarmed, by the height of the anæsthesia obtained. We have been relieved also in the majority of these occasions to find that in spite of the height of the anæsthesia there has been no serious respiratory embarrassment.

I must confess that my first efforts at spinal analgesia in chest surgery were made with some trepidation. The prospect of paralysis of the abdominal and intercostal muscles in a patient whose respiration is already embarrassed by diminished vital capacity and by unilateral pneumonothorax is ominous in its import.

Nevertheless spinal analgesia appears to be a practical and safe procedure for lower thoracoplasty and lobectomy.

In conjunction with Dr. Machray 23 spinals have been given for lobectomy and pneumonectomy, and although the numbers are not large they provide us with some first-hand information on the subject.

A co-operative patient is a necessary asset, and, as already indicated in my remarks on preliminary medication, every effort should be made to preserve this asset intact. Naturally, however, a preliminary sedative is required. Our practice has been to give omnopon gr. $\frac{1}{3}$ and scopolamine gr. 1/150 and intravenously just sufficient nembutal to produce quiescence without loss of consciousness. Two grains is about the average dose. The patient in this condition will obey commands. He will hold his breath or cough as required although frequently there is no memory of the operating theatre.

We have used percaine 1/1,500 to produce spinal analgesia, following the Howard Jones technique for upper abdominal surgery. While the patient is in the ventral position care is taken to lower both head and feet thus bringing the upper dorsal vertebrae into the highest position. With a hypobaric solution it appears logical to endeavour to obtain the necessary height of anæsthesia in this manner without increasing the dose.

After six minutes the patient is put into position for operation plus 30 degrees Trendelenburg. The operation then proceeds.

In three cases I attempted to gain height by using a 1 in 2,000 percain solution in greater quantity. In two of these analgesia was imperfect. In a few cases while using the 1 in 1,500 solution analgesia was incomplete at the upper limit of incision and necessitated the addition of a local injection at this point.

The outstanding fact about spinal analgesia in the surgery of the chest is the manner in which it upsets previous conceptions about positive pressure in the presence of open pneumothorax. The patient is usually able to breathe quite well and rarely has it been necessary to administer oxygen on account of cyanosis. The cough reflex remains active throughout and sputum is voided with reasonable ease.

There is usually a fall in blood-pressure but in the majority of cases this has not been sufficient to cause

anxiety. It is significant that the fall is less marked than in high abdominal operations under spinal analgesia. It is interesting to note also that retching, which can be so distressing a feature in abdominal operations, is noticeably absent. Post-operatively, the patient is placed in bed with the legs elevated. The chest is gradually raised while the legs are kept in this position. By such a compromise we provide the precautions necessary after any spinal anæsthetic and also those particular to a thoracic operation which calls for the assumption as early as possible of the semi-sitting position. There have been some post-operative headaches, the incidence of which is of no greater import or frequency than with spinal analgesia in other branches of surgery.

III. *General Anæsthesia.*

When we consider general anæsthesia in the surgery of the chest our minds turn naturally to nitrous oxide and oxygen. It is the most innocuous combination known, as far as chemical effects are concerned. It is non-inflammable, an important factor when diathermy is employed, as it so often is, in these cases. Where, formerly, I pursued with relentless vigour the ideal of pure nitrous oxide and oxygen in chest surgery on account of the absence of toxicity, my experience with cyclopropane has caused me to modify my opinion as to the wisdom of such a practice.

I have already said that deep anæsthesia is usually unnecessary in thoracic surgery. It is true, therefore, that with premedication much can be accomplished with nitrous oxide and oxygen without the help of a further adjuvant. Pure nitrous oxide and oxygen anæsthesia implies at least some degree of suboxygenation, however, and it is surely better, if possible, to avoid this factor in patients whose oxygenation area is already diminished by disease.

When diathermy is employed chloroform is the only adjuvant which can be used without involving the risk of explosion. In the absence of diathermy vinyl ether is to be preferred. Vinyl ether is without the disadvantages of chloroform, but is equally potent. It is less pungent than ether. The effects are quickly obtained and conveniently evanescent. The discriminate use of an adjuvant in this

way would appear to be less harmful than the subjection of these patients to cyanosis in any degree.

On the subject of pure nitrous oxide and oxygen in chest surgery there is some difference of opinion. Mr. Hewer[5] states in a recent publication that after trying out most of the possible alternatives pure nitrous oxide and oxygen is his choice anæsthetic in thoracic surgery—and this with quite moderate premedication. On the other hand, Sellers[6] states, quite fairly I think, that the cyanosis, bleeding and laboured respiration in nitrous oxide-oxygen anæsthesia are not consistent with the idea of pulmonary rest in lung disease.

Shields[7] objects to nitrous oxide and oxygen on the grounds that it gives rise to shock due to an inability to maintain adequate oxygenation and satisfactory anæsthesia at the same time. It is significant that nitrous oxide-oxygen has been displaced by cyclopropane in some other chest hospitals in America.

It is time, I think, that the position of nitrous oxide and oxygen was placed on an honest basis, consistent with surgical requirements in this country, not only in the surgery of the chest but in general surgery as well. We know its value; we know also its limitations. When one is called upon to meet the demand so often made nowadays, for gas and oxygen for any and every operation, whether it be the removal of a foreign body from the bronchus or a gastrectomy, one is tempted to suspect that this demand arises from previous experiences of nitrous oxide and oxygen, not altogether pure and unadulterated. In making such a statement I am aware that I leave myself open to obvious conclusions as to my inefficiency. Nevertheless, I am convinced that alternate bouts of cyanosis and oxygen inflation are unlikely to enhance the prospects of cure in patients suffering from pulmonary disease.

Evipan has proved its advantages as a complete anæsthesia in thoracic surgery for short operations, as it has done in other branches of surgery. I have found it to be particularly useful in the external drainage of lung abscesses. When the needle is kept in position, successive small doses can be given as required without interfering with the cough reflex. There is no doubt that other derivatives such as

pentothal will prove equally useful or even superior to evipan in selected cases.

Chloroform and oxygen produce quiet anæsthesia without increased bleeding, and the mixture is non-inflammable. It does not appear justifiable, however, to use chloroform alone, if it can be avoided, in patients who are suffering from chronic suppurative disease.

The Handicap of Diathermy.

With the exception of short operations which can be completed under evipan, diathermy practically curtails the choice of general anæsthetic to nitrous oxide and oxygen, and chloroform.

Ethylene need not be considered since it has been largely replaced by cyclopropane.

Cyclopropane has been adequately dealt with by Dr. Rowbotham[3] in his comprehensive paper read at the last meeting of the Section. On that occasion I recorded my own experience with the gas in thoracoplasty.[9] It is unnecessary, therefore, for me to enter into the details of administration. I need only repeat that cyclopropane is, in my opinion, a godsend in the surgery of the chest. I feel certain that the operator who is able to forgo the advantages of diathermy in favour of the atraumatic anæsthesia which cyclopropane provides, is amply repaid for his concession.

Cyclopropane is slightly more nauseating post-operatively than nitrous oxide and oxygen, but one finds on careful investigation that the latter combination is not so completely devoid of after-effects of this nature as it is popularly supposed to be.

Methods of Administration.

The barbiturates are the only agents which can be regarded as of practical value for intravenous use at the present time. They have already been mentioned in this category.

As regards the gases at present at our disposal, administration by means of a face piece and retention harness is all that is necessary in the majority of cases. In order to maintain the airtight fit which is so essential with closed circuit

methods a chin-strap proves a useful addition to Dr. Clausen's harness.

Should the airway become troublesome, a short Silk's tube passed through the nose is tolerated more readily under light anæsthesia than an airway of the Hewitt type. A few drops of any of the ephedrine-paraffin combinations will usually keep the nasal airway free without the necessity for any artificial device.

In certain cases, however, control of the larynx by intubation is essential to the safety of the patient under general anæsthesia.

Opinions are divided as to the necessity for intubation in thoracic surgery. Coryllos[10] apparently uses the intubation method for all thoracoplasties. He employs a metal tube which he introduces before induction of anæsthesia. While intubation facilitates suction which is necessary in certain cases it is not an essential factor in anæsthesia for the average thoracoplasty. At least that is our experience at the Brompton Hospital.

On the other hand, some authorities hold that intubation is unnecessary for any thoracic operation on the grounds that with deep anæsthesia spasm of the larynx does not occur. The wisdom of producing such a depth of anæsthesia in these patients without intubation is open to question, since deep anæsthesia is antagonistic to rapid recovery and return of the reflexes. It also leaves the patient without the natural protection of the cough reflex, or the mechanical protection of suction during the course of the operation.

It is unnecessary to enlarge upon the well-known advantages of intubation. During the progress of an extensive intrathoracic operation, the import of even brief laryngeal closure is obvious. Events move so rapidly in such circumstances that it is wiser to avoid their occurrence by the protection which intubation affords. In addition, intubation is necessary for the conduct of endotracheal and endobronchial suction during the course of certain operations, particularly in lobectomy and pneumonectomy for bronchiectasis.

It will be appreciated that the presence of abundant secretion in the respiratory tract may act adversely in two

ways. (1) The secretions may be sufficient to block the trachea completely at times, or (2) they may spread to another lobe on the affected side, or to the opposite lung, with atelectasis or subsequent pneumonia as a result. For these reasons lobectomy and pneumonectomy for bronchiectasis present a problem which does not arise when the operation is undertaken for new growth.

The conditions pertaining to the former operations have given rise, therefore, to certain developments in intubation technique which are peculiar to thoracic surgery.

Alternative Methods of Intubation.

Method I. Endotracheal anæsthesia is established by means of a rubber tube passed through the mouth or nose in the usual manner. With the aid of a laryngoscope and stilette, a catheter is then passed into the trachea, or into the bronchus on the affected side and left *in situ*, suction being applied when necessary. Should it be desired to employ an inflatable cuff on the anæsthetic tube, a T-shaped metal connection closed at one end with a rubber cap makes practicable the passage of the catheter through the lumen of the tube when required.

Method II. The second method originated with Waters, and entails the passing of a tube into the bronchus on the sound side combined with inflation of a rubber balloon at the bifurcation of the trachea. The insertion of a tube into the bronchus in this manner may be easy in theory, but is more difficult in practice. It is clear that such a tube must be accurately placed if it is to function effectively, and since I am unfamiliar with Water's own technique, with accuracy in view, I have devised for the purpose the instrument now shown (Fig. 1). The essential parts consist of a stiff inner canula (Fig. 1*a*) illuminated at the distal end from a battery in the handle. The canula is surmounted by a close spiral composed of fine metal tubing. The spiral is covered in turn by close-fitting thin rubber tied securely in position with silk in three places. The intervening piece of rubber between the two distal fastenings (Fig. 1*b*, *c*) forms the cuff which is inflated by means of a syringe. This method of using the spring coil itself as an air channel is, I believe, original. Actually this instrument was used at

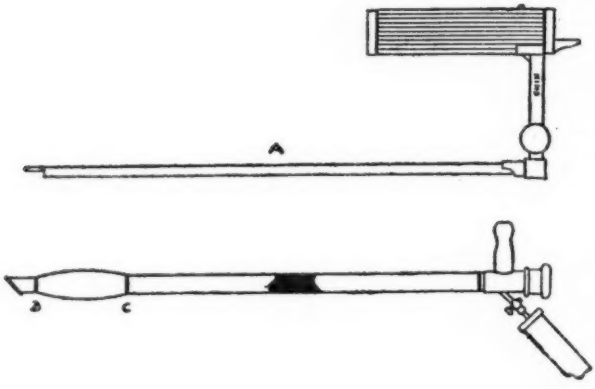

FIG. 1.

first with the cuff in the bronchus, the idea being that in this position the bulk of the cuff would not prevent suction on the opposite side. This proved impracticable for two reasons: (1) There was an obvious risk of occluding the upper lobe bronchus when the instrument was used on the right side. (2) The small balloon could easily be dislodged by surgical traction within the thorax or even by respiratory movements. This is explained by the fact that bronchi elongate and contract during respiration, whereas the tube is more or less rigid longitudinally.

In the trachea, on the other hand, a much larger balloon can be used, and with the greater purchase afforded thereby, there is less risk of the tube being dislodged from its correct position.

Method III entails the use of an endotracheal tube for anæsthesia combined with the insertion into the bronchus on the affected side of a suction catheter bearing a balloon to close off the main bronchus. At first I carried out this manœuvre with a laryngoscope and the directional aid of a stilette, but here again with a view to more accurate deposition of the catheter, I devised the combined tracheascope and anæsthetic tube now shown (Fig. 2). To use this instrument, the larynx is cocainized as for bronchoscopy. The tracheascope is then inserted, and the suction catheter passed through its lumen into the bronchus on the affected

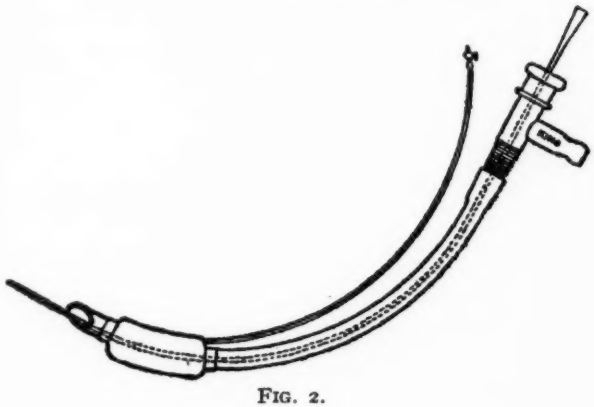

FIG. 2.

side before induction of anæsthesia. When the catheter is in position the carrier is withdrawn, leaving the anæsthetic tube (Fig. 2*b*) in the trachea. In this way the protection of suction is in force before the dislodgment of secretions can occur, as it is liable to do, during the induction period. If desired an inflatable cuff can be mounted on the part which lies in the trachea.

I should like at this point to express my appreciation of the valuable help of Mr. Tally, of Messrs. Charles King Ltd., in carrying out the design of these instruments.

In the methods described, it is apparent that the first has been evolved with a view to removal of bronchial secretions while the operation is in progress. In the second method the object aimed at is to confine the secretions at any rate to the affected lung, without any attempt at removal during the operation. The third method may be described as a combination of the other two.

DISCUSSION OF METHODS OF INTUBATION.

The effective application of any of these methods depends naturally on the dexterity of the anæsthetist and also to some extent on the age and development of the patient.

Method I is applicable to patients of any age, but the accurate insertion of tubes or catheters bearing inflatable cuffs may be a matter of some difficulty and should not be attempted in small children.

Method II is particularly suited to pneumonectomy. When used for lobectomy, since suction is not provided, there is a considerable risk of secretions being transferred to the sound lobe during manipulation of the lobe to be removed.

Method III appears to me to be a logical method of dealing with the problems of lobectomy. It provides for suction without any interference with anæsthesia. The affected lung is deflated and easy to handle. The small balloon prevents secretions from reaching the trachea in the intervals when suction is not applied. The flexibility of the rubber cap allows for movemnt of the catheter in accordance with the movements of the bronchus at the distal end.

The majority of lobectomies are undertaken for lower lobe lesions. With greater practice there appears to be no reason why the balloon should not be placed distally to the origin of the upper lobe bronchus in these cases, thereby protecting the upper lobe and ensuring its function during the operation.

Carbon Dioxide Absorption.

Whether administration is by face piece or by intubation carbon dioxide absorption offers advantages which are likely to lead to its application whenever possible with gas or vapour anæsthesia.

Any device or agent which assists in preventing hyperpnœa is of material help to both surgeon and patient. Carbon dioxide absorption fulfils this object. It is economical—a factor of considerable importance with cyclopropane. It prevents the odour of the anæsthetic from disturbing the operator and his assistants. It lessens the risk of ignition of inflammable gases.

Positive Pressure.

Whatever difference of opinion there may be as to the necessity or otherwise, for intubation in certain thoracic operations, it is generally held that positive pressure anæsthesia is necessary when the thorax is open and the pleura free. Sellors[11] goes so far as to say that positive pressure is a *sine qua non* under these conditions.

The use of low positive pressure is a common practice with gaseous anæsthetics. It assists pulmonary ventilation

and absolves the patient from the extra work of overcoming the inertia of a column of gas.

While positive pressure is obviously essential in the rare event of bilateral pneumothorax, and in emergencies, the necessity for it in every thoractomy is not so apparent.

The respiration of a patient undergoing thoractomy under spinal analgesia is interesting in this connection. Here, not only is the thorax open, but some of the accessory muscles of respiration are paralysed, and yet the patient continues to breathe with remarkable absence of dyspnœa or cyanosis.

Apart from the question of assisting ventilation, however, it appears to me that when sputum is abundant, pressure that is sufficient to inflate a diseased lung involves definite risks in its application. Constant positive pressure applied through a face piece or endotracheal tube at a level high enough to abolish respiratory movement or reduce it to a minimum, is an impediment to pulmonary circulation. It is necessary, therefore, to reduce the pressure at intervals. During these intervals, however short, secretions are liable to reach a point from which they may not only be aspirated, but actually forced into another lobe or into the opposite lung when the pressure is raised again.

Emergencies apart, the only instance in which positive pressure is of value is in the presence of a bronchial fistula. Here, however, the term is anomalous, for the fistula is in effect a safety valve which prevents the pressure from being raised appreciably. In such a case blood and secretions are diverted externally via the fistula rather by the increased volume of the gases than by their pressure.

Whether the thorax is open or not it is my own practice to use the lowest pressure consistent with smooth anæsthesia.

In lobectomy this pressure is frequently less than 1 mm. of mercury as measured by a water manometer; rarely is it above 8 mm. of mercury.

It appears to me illogical to apply positive pressure greater than this to diseased lung tissue if it can be avoided.

Conclusions.

The practice of using local analgesia in preference to general anæsthesia is clearly sound in thoracic surgery,

since the relatively greater disadvantages of the latter are avoided. On this basis it may be argued that local analgesia should be given first preference whenever possible.

Spinal analgesia has already been referred to. In the opinion of Shields, who weighs arguments carefully, spinal analgesia is in every respect superior to other methods in lower lobectomy and lower thoracoplasty. My own experience confirms this opinion.

The short-acting barbiturates are useful in short operations. It is not improbable that by means of continuous injection some of the new members of the group may prove their value in major procedures.

While the majority of patients in this country demand to be unconscious during operation, and since the apparatus employed for delivering gaseous anæsthetics gives controllability, assists pulmonary ventilation, and provides sufficient positive pressure should this be required in emergency, the choice of anæsthetic at present lies with nitrous oxide and oxygen, with vinyl ether or chloroform in the background as an adjuvant, or with cyclopropane. The respective positions of these agents in the surgery of the chest and the limitation of choice imposed by diathermy have been discussed.

I feel that this account of anæsthesia in major thoracic surgery and in lobectomy in particular, will prove disappointing to many of you. I make no excuse for this, for the experimental stage is not yet passed. It would be well to bear in mind, however, that the removal of the whole or part of a lung is still an operation of gravity. However great the improvement in anæsthesia in the future there will surely remain a limit to what the surgeon can accomplish in the chest with reasonable immediate safety and reasonable hope of cure.

Discussion.

Mr. I. W. Magill (in reply) said that any tendency towards atelectasis occasioned by suction through a cuff-bearing catheter could be overcome by inflation after ligature of the stump, or by aspiration of air from the pleural cavity after closure of the chest wall. He thought that when immediate post-operative suction by bronchoscope re-

vealed the presence of blood or secretion on the opposite side, it was clear that the suction carried out by the anæsthetist had been inadequate. As regards spinal analgesia he had not exceeded 15 cc. of 1 in 1,500 percaine in any case. The combination of abundance of oxygen with CO_2 absorption made a considerable contribution to the quiet respiration noticeable with cyclopropane. CO_2 absorption could be used with advantage to diminish respiratory rate and excursion when nitrous oxide-oxygen was employed.

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ANÆSTHETIC DEATHS IN MELBOURNE, 1929-1934.*

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IN 1930 the present writer analysed 107 anæsthetic fatalities brought to inquest before the City Coroner of Melbourne in the years 1919 to 1929.[1] Since 1929 interest in anæsthesia has advanced considerably, and new drugs and methods have entered general use. It seemed desirable, therefore, to review the fatalities brought to inquest between July 1st, 1929, and June 30th, 1934. This review is embodied in the present paper, which may be regarded as a continuation of the work done in 1930.

Definition.

The 25 cases in the present series include patients who died (*a*) whilst actually under an anæsthetic, or (*b*) after returning to bed, but before awakening from the effects of the anæsthetic. Deaths occurring several hours after anæsthesia was terminated, and due apparently to grave injury or disease, have been excluded. Data are wanting for any inquiry into fatal post-operative respiratory sequelæ.

Distribution of Deaths.

Sixteen deaths occurred in public hospitals and six in private hospitals. In three other cases the anæsthetic agent was apparently taken with suicidal intent. The agent employed was a general anæsthetic in 22 cases and a local anæsthetic in three cases.

* Presented to the Australian Society of Anæsthetists, Melbourne, September 17th, 1935.

Percentage Anæsthetic Mortality.

In 1919 to 1929 an average of 10.7 anæsthetic fatalities came to inquest yearly. In 1929 to 1934 the annual average was only 5.0 fatalities. This does not necessarily mean a decline in the anæsthetic mortality, because not every anæsthetic death comes to inquest. It is open to the coroner to give a simple order for burial in cases in which he feels that an inquest would serve no useful purpose. This discretionary power seems to be more often employed now than formerly.

The writer is indebted to the City Coroner of Melbourne for the following statement: "'Where a death occurred whilst the patient was completely or partially under the influence of an anæsthetic, it has been my invariable practice to have a post-mortem examination made . . . I have not held an inquest when the findings of the pathologist showed (*a*) that an anæsthetic was used, (*b*) that according to the statements of the doctor(s) concerned the anæsthetics used were proper as to substance and quality and that the manner of their induction was in accordance with accepted practice, (*c*) that their use was only a minor factor in causing death, (*d*) that there were no circumstances of suspicion surrounding the death, (*e*) that the operation, if commenced, proceeded along traditional lines. I am unable to say if my predecessors took the same course. . . . I have been moved by motives of economy in avoiding, in this connexion, inquests that offered no promise of serving a useful purpose.''

This series of cases can give us, then, no clue as to any possible fall in the anæsthetic mortality since 1929. Its interest lies only in its being to some extent a selected series, in which the Coroner ordered an inquest because he wished to be more fully satisfied as to the soundness of the anæsthetic and surgical technique employed.

A clue to the present mortality in Melbourne is obtainable from the operation registers of our hospital. In 1919 to 1929, 13,400 operations were performed upon in-patients, with a death-rate "on the table" of 1.8 per 1,000. During 1929 to 1934 a total of 17,757 similar operations was recorded, with a death-rate "on the table" of 1.3 per 1,000. Details are as follow:—

Anaesthetic.	Cases.	Fatalities.
Ether (all techniques)	8,899	6
Chloroform	132	
Nitrous Oxide, Ethylene	2,255	13
Ethyl Chloride	22	
Spinal Anaesthesia	907	1
Regional and Local	2,393	4
Anaesthetic unstated	3,149	
	17,757	24 = 0.13%

In this series, the number of local anæsthetics is swelled by many cases requiring ophthalmic operations or endoscopy. The majority of the spinal anæsthetic administrations were for gynæcological operations. In the group marked "Anæsthetic Unstated," there was evidence that an anæsthetic had been employed and an operation performed, but no further details were available. Had any fatalities occurred in this group, it is reasonable to infer that the fact would have been recorded.

In the above series, as in the series published in 1930, most of the deaths occurred in cases where the patient was gravely ill or the operation was of great severity. This applies especially to the gaseous anæsthetics, which are selected for the worst "anæsthetic risks." In the series above, the mortality for the 2,255 gas cases was 6 per 1,000. This is actually less than the mortality in an earlier series of 1,937 gas cases reported from our hospital in 1931[2] and in which the mortality was 8.3 per 1,000.

It would seem, from the figures adduced by Clement,[3] and from our statistics, that the anæsthetic mortality in unselected cases is of the order of from 1 to 2 per 1,000. It would seem that, in our hospital, the mortality in in-patient surgery has fallen from 1.8 to 1.3 per 1,000 since 1929. Slight as this difference may seem to be, it represents (in the 17,757 cases above mentioned) eight fewer fatalities than would have occurred at the 1929 death-rate.

It is now proposed to analyse the data obtained in connexion with the 25 inquests upon cases of death during anæsthesia in Melbourne, 1929 to 1934.

Deaths under Chloroform.

Three deaths occurred under this drug, all in the induc-

tion stage. In two instances death occurred shortly after a change had been made to "open" ether anæsthesia, but before more than an ounce of ether had been given. In two cases failure of circulation and respiration was apparently synchronous; in the third, respiratory failure preceded cardiac. Details are given in Table I.

TABLE I.

Deaths Under Chloroform.

No. 1, age 43, female sex. *Pre-operative state*: Much blood-loss; fast, weak pulse; "hæmic" bruit. *Operation*: Curettage for uterine hæmorrhage. *Died*: During induction.* *Failed first*: Respiration. *Heart*: Some hypertrophy and dilatation, coronaries rather small. *Lungs*: Normal. *Kidneys*: Normal. *Other organs*: Uterus large, with thickened prominent vessels. *Comment*: Chloroform injudicious.

No. 2, age 20, female sex. *Pre-operative state*: Apparently healthy. *Operation*: Diathermy of anal papillomata. *Died*: During induction. *Failed first*: Respiration and circulation. *Heart*: Relaxed, sl. atheroma; valves, coronaries normal. *Lungs*: Congested. *Kidneys*: Normal. *Other organs*: Normal. *Comment*: Heart probably not abnormal, chloroform not essential.

No. 3, age 22, female sex. *Pre-operative State*: Apparently healthy. *Operation*: Gynæcological laparotomy. *Died*: During induction.* *Failed first*: Respiration and circulation. *Heart*: Relaxed, dilated; some aortic and mitral atheroma. *Lungs*: Congested. *Kidneys*: Congested. *Other organs*: General congestion, ovarian cyst present. *Comment*: Chloroform not essential, slight abnormality of heart.

* Had actually changed to "open" ether, although not above an ounce of ether had been given.

Pathological findings. One patient (No. 1) had suffered from severe uterine hæmorrhage. The other two patients presented slight aortic atheroma, but, as they were young adults and apparently free from clinical evidence of cardiac deficiency, one can scarcely attribute the fatal issue to this cause. The pathological findings do not account for their deaths.

Choice of anæsthetic. In one patient (No. 2) chloroform was employed to permit the use of the diathermy apparatus, a choice by no means obligatory in a metropolitan hospital in the year 1933. In case No. 3 a less toxic drug might well have been employed, and in case No. 1 (the patient with uterine hæmorrhage) should have been employed.

Comment. Chloroform was responsible for three deaths during 1929 to 1934. All occurred in the induction stage, again illustrating its dangers. Of the three patients, two presented no definite organic lesion to account for death. The use of chloroform was never obligatory and, in the case of the patient debilitated by hæmorrhage, was injudicious.

Death under Ethyl Chloride.

Only one death was recorded following administration of ethyl chloride. Taxis for reduction of strangulated inguinal hernia was to be performed upon a man aged 71 years. Anæsthesia was induced with ethyl chloride and, just as a change was being made to "open" ether, respiratory failure occurred.

Autopsy revealed aortic atheroma and atheromatous obstruction of the coronary arteries. The lungs were very congested and the airways full of gastric contents. The liver was friable, the kidneys subgranular, with adherent capsules. The brain was congested. Some coils of gut were hæmorrhagic, but the inguinal hernia actually contained no bowel. Death was apparently due to asphyxia by inhaled vomitus, the senile degeneration of the heart rendering it additionally sensitive to asphyxial changes. It is possible, however, that the degenerate heart may have succumbed to the toxic action of ethyl chloride, and that the gastric contents were forced into the air-passages during attempted artificial respiration.

Deaths under Ether "Sequences."

Seven deaths were recorded in which anæsthesia had been induced with ethyl chloride or chloroform and maintained with ether. None occurred in the induction stage, and only one after the termination of the operation. In four cases initial failure of respiration was observed. Primary circulatory failure was present in one case, and synchronous arrest of circulation and respiration in another. In one case the evidence was insufficient for this point to be determined. Details of individual cases are given in Table II.

TABLE II.

Deaths Under Ether "Sequences."

No. 1, age 23, male sex. *Pre-operative state*: Healthy. *Operation*: Tonsillectomy. *Induced with*: Ethyl chloride.* *Died*: 30 minutes after induction began. *Failed first*: Respiration. *Heart*: Muscle hypertrophied, valves normal, pericardium adherent. *Lungs*: Congested, oedematous, full of frothy fluid, smelling strongly of ether. *Kidneys*: Sl. degenerative changes. *Other organs*: Normal. *Comment*: Pulmonary oedema; heart not normal; did ether enter lungs?

No. 2, age 11, female sex. *Pre-operative state*: Healthy. *Operation*: Nasal antrostomy. *Induced with*: Ethyl chloride.* *Died*: 10 minutes after operation began. *Failed first*: (?). *Heart*: Dilated; else normal. *Lungs*: Congested, some blood-stained froth in airways. *Kidneys*: Normal. *Other organs*: Normal. *Comment*: No organic lesion to account for death.

No. 3, age 3, female sex. *Pre-operative state*: Pneumonia and empyæma previously, due to foreign body in lung; condition at time of anæthesia fair. *Operation*: Bronchoscopy. *Induced with*: Ethyl chloride. *Died*: On insertion of bronchoscope. *Failed first*: Circulation. *Heart*: Base of aorta slightly atheromatous, else normal. *Lungs*: L. lung adherent and riddled with abscesses; pus in airways; tack in L. bronchus. *Kidneys*: Normal. *Other organs*: Normal. *Comment*: Death from reflex syncope?

No. 4, age 19, male sex. *Pre-operative state*: Healthy. *Operation*: Septum and Tonsils. *Induced with*: Ethyl chloride.† *Died*: 10 minutes after operation ended, catheter was withdrawn. *Failed first*: Respiration. *Heart*: Normal, great veins congested. *Lungs*: Congested; blood in airways; sl. laryngeal oedema: *Kidneys*: Large, firm, adherent capsules. *Other organs*: Normal. *Comment*: Asphyxia by inhaled blood; cough reflex had returned before catheter was removed.

No. 5, age 17, male sex. *Pre-operative state*: Healthy. *Operation*: Appendicectomy. *Induced with*: Ethyl chloride. *Died*: 65 minutes after operation began. *Failed first*: Respiration. *Heart*: R. heart slightly dilated, else normal. *Lungs*: Very congested . *Kidneys*: Congested. *Other organs*: Congested. *Comment*: Osphyxial death explained by no organ lesion.

No. 6, age 19, male sex. *Pre-operative state*: Healthy; recent splenectomy for ruptured spleen. *Operation*: Fæcal impaction in anus. *Induced with*: Ethyl chloride.‡ *Died*: On dilatation of anus. *Failed first*: Respiration 'and circulation. *Heart*: Heart slightly dilated, else normal. *Lungs*: Congested. *Kidneys*: Congested. *Other organs*: Congested. *Comment*: Death from reflex syncope?

* Endopharyngeal administration of ether.
† Endotracheal administration of ether.
‡ Had taken previous anæsthetic well.

TABLE II (*continued*).

Deaths Under Ether "Sequences."

No. 7, age 19, male sex. *Pre-operative state*: Not robust; albuminuria. *Operation*: Appendicectomy. *Induced with*: Chloroform and ether, (1: 3). *Died*: On opening peritoneum. *Failed first*: Respiration. *Heart*: Much hypertrophy and dilatation, valves normal. *Lungs*: Congested. *Kidneys*: Very contracted, tough, granular, capsules adherent. *Other organs*: Congested. *Comment*: Cardio-renal disease.

Pathological findings. Pulmonary oedema was present in one case (No. 1), together with abnormality of the heart. One patient (No. 7) suffered from cardio-renal disease. Asphyxia from inhalation of blood occurred in one case (No. 4). In two cases (Nos .3 and 6) death appears to have resulted from reflex syncope. Two patients (Nos. 2 and 5) presented no organic lesion to account for death.

Choice of anæsthetic. The choice of ether was reasonable in most instances, and induction with ethyl chloride or chloroform would not have materially enhanced the risk. In case No. 3 ether must have been undesirable in view of the pulmonary condition, but was apparently used as a safer alternative to chloroform and as avoiding the great technical difficulty of bronchoscopy under gaseous anæsthetics. In case No. 7 gas anæsthesia might have been a wiser choice.

Comment. Pathological conditions likely to reduce tolerance to an anæsthetic were present in two patients, one suffering from cardio-renal disease and one from lung-abscess due to the presence of a foreign body. In the latter case death appears to have been due actually to reflex syncope caused by passing a bronchoscope through the larynx. One patient succumbed to reflex syncope caused by dilatation of the anus, an eventuality which could hardly have been prevented. One fatality, due to inhalation of blood, was definitely preventable. In two cases autopsy revealed no organic lesion to account for death. One fatality offers difficulty in classification. Death was apparently due to pulmonary oedema, which may have implied failure of a certainly abnormal heart. On the other hand, anæsthesia had been maintained by mean of an unguarded Junker's apparatus standing in a warm water bath. It is thus possible that condensed fluid ether may have entered

the patient's lungs, which would account for the pulmonary oedema and the strong ethereal smell observed at autopsy.

Deaths under "Open" Ether.

Five deaths occurred under "open" ether anæsthesia. One took place in the induction stage and one during the operation. The remaining three occurred after the operation had ended, but before the patients had recovered from the effects of the anæsthetic. Respiratory failure was observed in the patient dying in the induction stage. In two of the post-operative fatalities death was suffocative, the third showed synchronous failure of heart and respiration. The evidence in the case of death during operation was insufficient for the manner of death to be determined. Details of individual cases are given in Table III.

TABLE III.

Deaths Under "Open" Ether.

No. 1, age 65, male sex. *Pre-operative state*: Healthy apart from local lesion. *Operation*: Abscess of alveolus and base of tongue. *Died*: During induction. *Failed first*: Respiration. *Heart*: Relaxed; muscle friable; coronaries atheromatous. *Lungs*: Congested; glottic œdema; pus in left bronchus. *Kidneys*: Normal. *Other organs*: Normal. *Comment*: Syncope from entry of pus into lung; senile cardiac changes.

No. 2, age 22, male sex. *Pre-operative state*: Healthy. *Operation*: Septum and tonsils.* *Died*: 50 minutes after anæsthesia began. *Failed first*: (?). *Heart*: Relaxed; dilated; slight aortic atheroma. *Lungs*: Congested; some blood in airways. *Kidneys*: Congested; firm; capsules slightly adherent. *Other organs*: Normal. *Comment*: No organic lesion to account for death.

No. 3, age 25, male sex. *Pre-operative state*: Healthy. *Operation*: Frontal sinus.† *Died*: 1 hour after end of operation. *Heart*: Relaxed; dilated; otherwise normal. *Lungs*: Airways full of blood and mucus. *Kidneys*: Normal. *Other organs*: Cerebral congestion. *Comment*: Asphyxia by inhaled blood; cough-reflex present before catheter removed.

No. 4, age 32, male sex. *Pre-operative state*: Healthy. *Operation*: Septum.† *Died*: 1¼ hours after end of operation. *Failed first*:

* Endopharyngeal administration of ether.
† Endotracheal administration of ether.

TABLE III (*continued*).
Deaths Under "Open" Ether.

Respiration. *Heart*: Slight aortic atheroma, else normal. *Lungs*: Engorged; hæmorrhagic; containing inhaled blood. *Kidneys*: Congested. *Other organs*: Congested. *Comment*: Asphyxia by inhaled blood; had moved and phonated before death; no specific reference to cough-reflex.

No. 5, age 20, female sex. *Pre-operative state*: Healthy: *Operation*: Appendicectomy‡ *Died*: 9 hours after operation, without regaining consciousness. *Failed first*: Respiration and circulation. *Heart*: Normal. *Lungs*: Congested. *Kidneys*: Normal. *Other organs*: Congested. *Comment*: Cardio-respiratory arrest during induction; restored 20 minutes later, after cardiac massage; appendix removed; death 9 hours later, without regaining consciousness; death due to excess CO_2 or to overdose of ether.

Pathological findings. Two patients (Nos. 3 and 4) were asphyxiated by inhaled blood. One patient (No. 1) died as a result of the entry of pus into the bronchial tree; his heart, too, was abnormal. The remaining two patients (Nos. 2 and 5) presented no organic lesion to account for death.

Choice of anæsthetic. The choice of ether was reasonable in all cases, although a gaseous anæsthetic might have been preferred for the patient with the abscess of the tongue (No. 1).

Comment. The patient dying as a result of entry of pus into the lungs suffered from an abscess of the jaw and base of tongue. During induction of anæsthesia the swelling of of the jaw was observed to become suddenly less in size; respiration then became embarrassed and failed before the circulation. It is thus probable that death was due less to failure of a degenerate and intoxicated heart than to syncope due to rupture of the abscess into the lungs. Endotracheal anæsthesia, although theoretically indicated, would not have helped, the abscess ruptured before the patient was ready for laryngeal intubation. Two deaths occurred after rhinological operations under endotracheal anæsthesia, both from inhalation of blood. It is commonly regarded as safe to remove a laryngeal catheter after the patient's cough reflex has returned. In one case this had certainly done so; in the other case it probably had, al-

‡ Induction with aid of carbon dioxide.

though the point is not explicitly stated. Most likely the patients' tongues had fallen back after the catheter was removed: a pool of blood therefore collected in the hypopharynx and was inhaled. It is probable that the insertion of a pharyngeal airway and more careful post-operative nursing would have prevented both these fatalities. In the fourth case a young and healthy woman was to undergo appendicectomy. Induction was with open ether, aided by carbon dioxide. Circulatory and respiratory failure occurred, either from overdose of ether induced by carbon dioxide hyperpnœa, or from fatigue of the respiratory centre caused by excessive administration of carbon dioxide. After twenty minutes, direct cardiac massage was performed and circulation restored: spontaneous respiration only returned twenty minutes later still. This interval between collapse and cardiac massage was probably long enough for irremediable anoxic changes to have occurred in the cerebral centres, which would explain the eventual death without recovery of consciousness. The decision of the surgeon to operate upon a patient so recently and so partially resuscitated was perhaps unwise, but probably did not much affect the issue. The fifth patient, a healthy young man, undergoing a rhinological operation, showed no organic lesion to account for death.

Deaths under Gaseous Anæsthetics.

Since gas anæsthesia is preferred in hospital practice for the worse "anæsthetic risks," the apparent mortality for this technique is high. Few of the fatalities come, however, to inquest, because the patients are often desperately ill and no useful purpose is to be served by further inquiry. The present series contains, therefore, but three deaths under gaseous anæsthetics. Nitrous oxide was employed in two instances and ethylene in one. No death occurred in the induction stage. Circulatory failure was observed in one case and respiratory failure in another; in the third, arrest of circulation and respiration were simultaneous. Details are given in Table IV.

TABLE IV.

Deaths Under Gaseous Anæsthetics.

No. 1, age 65, female sex. *Operation and anæsthetic*: Aneurysm R.; subclavian artery; (N_2O and O_2). *Pre-operative state*: Cardiac decompensation; operation done at patient's express desire. *Died*: 45 minutes after anæsthesia began. *Failed first*: Circulation. *Heart*: Extensive atheroma aorta and coronaries; great arteries sclerosed. *Lungs*: Slightly engorged. *Kidneys*: Friable; subgranular; capsules adherent. *Other organs*: Normal; aneurysm; R. subclavian artery. *Comment*: Cardio-renal degeneration; death from shock and heart failure.

No. 2, age 53, male sex. *Operation and anæsthetic*: Ileostomy for paralytic ileus; (N_2O and O_2). *Pre-operative state*: Gangrenous appendix removed 4 days before; intraperitoneal haemorrhage; ileus; blood-stained vomitus; desperately ill. *Died*: As last sutures were inserted. *Failed first*: Circulation and respiration. *Heart*: Enlarged; relaxed; dilated; muscle friable; coronaries thickened. *Lungs*: Engorged. *Kidneys*: Smooth; firm; capsules adherent. *Other organs*: Free blood in peritoneum. *Comment*: Death from shock; apart from ileus, cardio-renal functions are open to doubt.

No. 3, age 25, female sex. Exophthalmic goitre; (C_2H_4 and O_2). *Pre-operative state*: Gravely ill; pulse 140 per minute. *Died*: Immediately after end of operation. *Failed first*: Respiration. *Heart*: Fair condition. *Lungs*: Congested; airways full of thick, frothy mucus. *Kidneys*: Congested. *Other organs*: Congested. *Comment*: Death from asphyxia by profuse mucous secretion embarrassing a thyrotoxic heart; change to endotracheal anæsthesia might have been wise.

Pathological findings. One patient (No. 1) presented gross cardio-renal disease, with aneurysm of the subclavian artery. The second patient (No. 2) suffered from paralytic ileus following intraperitoneal hæmorrhage after removal of a gangrenous appendix. The last patient (No. 3) actually succumbed to asphyxia from secretion of mucus, acting upon a heart weakened by thyreotoxicosis.

Choice of anæsthetic. Assuming that regional or local anæsthesia was inapplicable, the choice of anæsthetic was the safest possible.

Comment. Two patients, suffering respectively from cardio-renal disease with aneurysm and from paralytic ileus (also with cardio-renal abnormality), were very bad subjects for anæsthesia. Their deaths cannot be directly attributed to the anæsthetic or regarded as apparently preventable.

The third patient was seriously ill with thyreotoxicosis, and was therefore a bad "anæsthetic risk." It is just possible, however, that intubation of the larynx, aspiration of the bronchial tree and adoption of endotracheal administration might have averted a fatal issue.

Deaths under Local and Spinal Anæsthesia.

One fatality was recorded as having occurred under spinal, and two under local, anæsthesia. Individual details are given in Table V.

TABLE V.

Deaths Under Local and Spinal Anæsthesia.

No. 1, age 34, male sex. *Operation*: Septum and tonsils. *Pre-operative state*: Healthy. *Technique*: Local. *Anæsthetic*: Cocaine, gr. iv, as paste with adrenalin, for septum; novocain, 150 mg., with adrenalin, as local injection for tonsillar area. *Subsequent events*: Sudden "collapse" at end of uneventful operation lasting 25 minutes. *Heart*: Slow pericardial effusion; heart dilated; muscle tough and fibrous; some coronary atheroma; *Lungs*: Intense congestion. *Other organs*: Congested. *Comment*: Cocaine intoxication? heart not normal.

No. 2, age 23, male sex. *Operation*: Tonsils. *Pre-operative state*: Healthy; had successfully taken ether for antrostomy a week previously. *Technique*: Local. *Anæsthetic*: Local application of 10 per cent cocaine paint; ethocaine, 125 mg., locally injected into tonsillar area. *Subsequent events*: On completion of injection, became comatose; violent clonic convulsions; hypethermia to 106°F.; gradual circulatory failure in next 2¼ hours. *Heart*: Dilated, otherwise normal. *Lungs*: Congestion and œdema. *Other organs*: Congested. *Comment*: Cocaine intoxication? No organic lesion found to account for death.

No. 3, age 42, female sex. *Operation*: Laparotomy. *Pre-operative state*: Said to be an unsuitable "risk" for general anæsthesia, although reasons not given; spinal anæsthesia accordingly selected. *Technique*: Spinal. *Anæsthetic*: Ethocaine, 500 mg., dissolved in patient's cerebro-spinal fluid and re-injected; patient then moved from bed to operating theatre. *Subsequent events*: Pulse and respiration failed simultaneously when abdomen was being opened. *Heart*: Normal. *Lungs*: Congested. *Other organs*: Malignancy of right ovary, with secondary abdominal metastases. *Comment*: Dose dangerously high; choice of spinal anæsthesia and transportation of anæsthetized patient both open to criticism.

Pathological findings. One patient (No. 1) suffered from cardiac disease, and was presumably more than normally sensitive to the cardio-depressant action of local anæsthetics, especially of cocaine. The second patient (No. 2) showed no organic lesion to account for death. The last patient (No. 3) suffered from ovarian malignancy, but this was probably not the determining factor in the fatal issue.

Manner of death. Sudden cessation of circulation and respiration was observed in two patients. The third, however, displayed the convulsions associated with an overwhelming cocaine intoxication.

Choice of anæsthetic. With reservations in the case of cocaine, local anæsthetics are regarded as the safest possible choice. The patient dying under spinal anæsthesia received that anæsthetic because allegedly too ill for inhalational anæsthesia, a fallacious attitude towards spinal anæsthesia which has resulted in more than one calamity.

Comment. Both cocaine and the ethocaine group of drugs may produce intoxication. In cases 1 and 2, above mentioned, it is impossible to say definitely which of the two drugs was responsible for death. Due care was taken in each case that cocaine should not be swallowed by the patients, but, in view of the much greater toxicity of cocaine as compared to ethocaine, it is reasonable to assume that both were cases of cocaine poisoning. Case No. 2 was particularly interesting, in view of the rapid onset of violent clonic convulsions and of respiratory embarrassment which threatened to be fatal, until it was relieved by endotracheal insufflation of oxygen. The convulsions then continued at intervals of about one minute for the next two hours, and could not be abolished by administration of ether. The temperature, because of the muscular clonus, rose to 106°F. Respiration was sustained by endotracheal oxygen-administration, and death was eventually due to cardiac failure. The spinal anæsthetic death lends itself to criticism on three grounds, viz. (*a*) the dubious initial choice of spinal anæsthesia, (*b*) the dangerously large dose of ethocaine injected, i.e. 500 milligrammes, and (*c*) the undesirable practice of inducing spinal anæsthesia in bed and then transporting the patient to the operating theatre. On each and all of these

three counts the fatality may be regarded as having been preventable.

Self-administered Anæsthetics.

Three cases occurred of suicide by administration of anæsthetics. Ether was employed in one case and chloroform in two.

Case 1. An airman, aged 26 years, was addicted to inhalation of ether from a handkerchief. He was found dead in bed, profoundly cyanotic, with a bottle of ether by his side. Autopsy revealed intense congestion of all organs, especially of the lungs and air-passages. The stomach contents contained ether, indicating that the drug had been swallowed.

Case 2. A former soldier, aged 32 years, suffered from traumatic epilepsy following a shell-wound of the head. He became addicted to inhalation of chloroform to mitigate headache. He was found dead in bed, intensely cyanotic, and grasping a bottle of chloroform. Autopsy disclosed a relaxed and flabby heart, congested lungs, an atrophic cavity in the brain at the site of the old wound, and the presence of swallowed chloroform in the gastric contents.

Case 3. A woman, aged 40 years, had attempted suicide with chloroform three years previously. More recently she had been exposed to domestic and financial worries. She was found dead in bed, her head covered by bedclothes soaked in chloroform and an empty chloroform bottle lying near by. There is a reference to great discolouration of the face by intradermal hæmorrhages, but to no other autopsy findings.

Summary of Pathological Findings.

It is not easy, in reading depositions regarding anæsthetic deaths, to recreate the problems which faced the individual anæsthetists at the time. Further, post-mortem findings do not necessarily reveal the reasons for a particular fatality. The mere existence of a serious pathological lesion does not imply that the patient might not, under other conditions of anæsthesia or of surgery, have survived the operation. Further, pathological methods are not always helpful in

assessing possible disorders of function rather than of structure. Granting all these limitations, an inquiry such as the present may yet give a clue to the answer to two questions, which arise in every case of death during anæsthesia. The questions are simply whether disease-conditions existed in the particular patient which rendered an anæsthetic administration hazardous, and whether, in view of the above, the fatal issue was patently avoidable?

Excluding suicides, there were 22 fatalities in the series. The various pathological conditions present are set out in the table which follows. More than one pathological condition may have existed, but, in that event, emphasis is put on the condition most directly affecting the anæsthetic and its fatal issue.

TABLE VI.

Pathological Findings in 22 Cases of Anæsthetic Deaths.

Pathological condition	Cases.
Abnormal heart	1
Cardio-renal disease	2
Hæmorrhage	1
Inhalation of blood	3
Inhalation of pus	1
Inhalation of vomitus	1
Ovarian malignancy	1
Overdose of ether and/or CO_2	1
Paralytic ileus	1
Pulmonary oedema	1
Reflex Syncope	1
Reflex Syncope: pulmonary disease	1
Thyreotoxicosis	1
No organic lesion	6
	22

Preventability of Deaths.

In the following table an attempt is made to classify the above-mentioned 22 cases in terms of the possibility of having prevented a fatal issue.

Frankly Preventable (inhalation of blood, 3: overdose of ether and/or CO_2, 1: injudicious use of spinal anæsthesia, 1)	5
Probably Preventable (no organic lesion found to account for death)	6
Possibly Preventable (injudicious choice of chloroform, 1: possible entry of ether into lungs, 1: suffocation by mucus during thryeoidectomy, 1)	3
Possibly Unavoidable (inhalation of pus or vomitus during induction, 2: reflex syncope, 2: presence of cardio-renal disease, 2)	6
Probably Unavoidable (gravely ill patients, having cardiac disease and paralytic ileus, respectively)	2
	22

The high incidence of preventable deaths in the series is explained by the fact earlier mentioned, that really desperate "anæsthetic risks" are seldom made the subjects of public inquests in the event of death. It is in cases where the coroner requires further assurance that inquests are held.

Summary and Conclusions.

The present paper reviews 22 deaths under anæsthesia upon which inquests were held in Melbourne in the years 1929 to 1934. The possible conclusions to be drawn from the series are as follows:

(1) The small number of inquests in the period under review does not necessarily imply a reduction in anæsthetic mortality in Melbourne.

(2) If figures derived from our hospital may be applied to the metropolitan hospitals as a whole, there has been a slight but definite reduction of the anæsthetic death-rate during this period.

(3) The high incidence of preventable and probably preventable deaths in the series is explained by the conditions governing the decision to hold an inquest in a given instance.

(4) Whilst it is unreasonable to expect any man, even an anæsthetist, to employ faultless judgment and skill at all times and under all conditions, the fact still emerges that several lives were lost during 1929 and 1934 because of gross

errors in anæsthetic technique. Undue emphasis need not be put upon such considerations as the avoidance of chloroform in a hæmorrhaging patient, or the timely intubation of the larynx in a case where the patient's respiration has become embarrassed by mucus-secretion. It is sufficient to draw attention to such outstanding disasters as suffocation by inhaled blood in the period of recovery from the anæsthetic or embarrassment of the respiratory centre by overdose of carbon dioxide. The following recommendations are therefore put forward, not because they possess any novelty, but because they are each connected with one or more fatalities in the present series.

(*a*) Chloroform should be avoided unless directly indicated, and, above all, in toxic or exsanguinated patients. The induction stage, be it once more iterated, is the stage to be most feared.

(*b*) Anæsthetic apparatus in which air is blown through ether in a container requires an effectual guard-bottle.

(*c*) Spinal anæsthesia is not the anæsthetic of choice for patients who are "bad anæsthetic risks." Patients should be transported to the operating theatre before, and not after, the intrathecal injection.

(*d*) The danger of over-stimulation and fatigue of the respiratory centre from overdose of carbon dioxide should be remembered.

(*e*) The means of intubating the larynx and insufflating air or oxygen should be at hand whenever an anæsthetic is administered. In case of respiratory embarrassment there is no better form of artificial respiration.

(*f*) In general an artificial airway should be inserted before the patient is returned from the operating theatre to bed. Attendants should be trained to recognise and treat the causes of respiratory obstruction during the recovery period.

Acknowledgment.

The writer desires to express his thanks to the City Coroner of Melbourne and to the Registrar-General of the State of Victoria for permission to use the official archives, and to their officers for much freely-given assistance.

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COMBINED EVIPAN-NOVOCAIN ANÆSTHESIA

(Continued).

By GEORGE BANKOFF, M.D.

LOCALLY the evipan-sodium does not damage the veins, they remain patent even after a repetition of the administration. No investigaor has found signs of cumulative action and many have used it repeatedly without ill-effects. Rode, for instance, has injected evipan-sodium three times in two days for bi-lateral mastoiditis with high fever, Beck and Sebening have injected it nine times in succession and neither intolerance nor venous thrombosis have been observed. Other chemical investigations regarding the concentration of blood sugar, the function of the liver, the composition of urine, etc., have demonstrated practically no alterations produced by the evipan-sodium. The alkaline reserve is practically unchanged and the evipan is as innocuous as the local avertin anæsthetics.

The condition of the patients, their sex or age have no importance in regard to the evipan-sodium. Klages gives a wonderful account of his experience on 84 children aged from 2 months to 14 years. He did not observe any ill-effects in them, which give a particular importance to the evipan-sodium as an anæsthetic for children.

Even patients in a very grave state of hysteria or nervousness support the drug very well and the psychological effect is good.

EVIPAN ANÆSTHESIA FOR MAJOR OPERATIONS.

The rapid disintegration of the drug followed by the prompt recovery of the patient stamped the evipan as an ideal anæsthetic for short and minor operations, such as opening of abscesses, biopsies, reduction of fractures or dislocations, etc. Furthermore, tonsillectomy, resection of the ribs for empyema and various cystoscopic and bronchoscopic, etc., examinations have been successfully carried

out under evipan anæsthesia. In a case of a bilateral inguinal hernia Abel and Jarman found themselves obliged to inject for a second time during the operation. Rode has performed nine laparotomies for tubal pregnancy and placenta praevia. Weese has administered this anæsthesia in 10,000 cases for short operations without any fatal results, or alarm caused directly by the anæsthetic.

In the field of major surgery it seems that only A. Westerborn has employed the evipan-sodium as an anæsthetic. He began his experiments with this anæsthetic by using it for the beginning of the operation only, completing it with additional ether. Later on he carried out the major operations completely under evipan anæsthesia. This investigation found that patients react very differently to the drug, and therefore instead of establishing a scale of maximal doses on age, sex and body weight, etc., he prefers that the necessary dose to induce loss of consciousness should be the deciding factor in each individual case. An equal quantity of this dose is injected as soon as consciousness is lost, which should be sufficient to induce an anæsthesia lasting for about 20 minutes. The patient is kept continuously under complete anæsthesia during the whole period of the operation, by injecting periodically 1-2 c.m. of the solution whenever the patient shows signs of recovery. The amount of the solution is very variable, being greater in young patients. On the other hand, the debilitated require much less of the solution then those in robust health.

The results among 450 patients were excellent, not one death was recorded, a few of them were restless and excited during their recovery, some being so violent that they had to be forcibly kept still.

Personal Technique.

In order to avoid injecting large amounts of evipan-sodium solution, which although experimentally on animals did not show any particular ill-effect, and also taking into consideration that the evipan-sodium acts differently in many individuals, I have tried to modify the use of evipan in such a manner that it will be unnecessary to inject large

quantities, at the same time keeping the method reliable and certain.

The largest dose used at the present time by Westerborn has never exceeded 27 cc. of evipan-sodium solution. In some cases it was impossible to bring the patients into complete anæsthesia, for this reason it was necessary to give them additional ether or chloroform.

For these and other reasons my method intends to limit to a minimum the use of evipan, at the same time offering the best condition in which a surgical intervention should take place.

By combining the intravenous injection of 5–15 cc. of evipan-sodium solution with regional infiltration or blocking the sensitive nerves of the operative field, I have been able to bring the patient to an ideal condition, which I have never witnessed during my experience with all other types of anæsthesia. The procedure employed is as follows: The patient is prepared as usual one hour before the operation, and given hypodermically a combined injection of morphia and scopolamine in the proportion of $\frac{1}{4}$ grain to 100 grains. In the majority of cases this injection produces a condition of twilight sleep. The infiltration of the operative field is performed with one of the many procedures of local anæsthesia. In particular operations when blocking of the sensitive nerves is possible, preference should be given to this method. Soon after the local infiltration and blocking is complete, the patient is given intravenously 5–10 cc. of evipan-sodium solution, thus bringing him to a most ideal condition of relaxation and anæsthesia. The intestines and all other abdominal organs are paralysed, and any surgical intervention may proceed easily. The duration of this anæsthesia is variable in different patients, but always varies between 1–2 hours, thus offering the possibility of performing any type of operation.

When dealing with a very nervous hysterical patient it is advisable to inject first the evipan-sodium solution intravenously, followed by the local infiltration or blocking of the operative field; in this way no psychological ill-effect can arise.

Without describing further all the advantages of this anæsthesia, I should like to mention that this type offers to

me the most ideal condition I have ever witnessed. It could be employed for every type of patient; age, sex or different pathological conditions do not alter in any way the success of the anæsthesia itself, no morbid condition is present which could be taken as contra-indication.

Practically all my operations are performed under this combined evipan-novocain anæsthesia, and I have never had any fatal results and sincerely advise systematical use of this method which dispenses with all disadvantages of the other methods of anæsthesia.

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ABSTRACTS

"Spinal anæsthesia, relief of pain by subarachnoid alcohol injections." E. L. STERN. *Clinical Med. and Surg.*, January 1936, p. 7.

The author, after a few clinical observations, the most important of which is that the desirable concentration for temporary anæsthesia is about 30 per cent of alcohol, gives with illustrations an account of a number of experimental injections into the subarachnoid space. His conclusions are summarized in brief as follows:

(1) Alcohol introduced into the subarachnoid space produces an immediate blocking of nerve impulses in the dorsal roots.

(2) Following the use of 95 per cent or absolute alcohol in small doses (under 16 minims) diminution or loss of touch, pain and temperature sensation may ensue and last several months. Severe intractable pain may be relieved for as long as twelve months after a single injection. With these small doses there is no motor paralysis, with larger doses one may cause paralysis or loss of muscle tendon and joint sense. There is definite evidence that sympathetic nerve-fibres may be affected by intra-spinal injection.

(3) Varying degrees of meningeal inflammatory reaction result from endothecal injection of anæsthetic solutions.

(4) After 24 hours alcohol causes the myelin in the dorsal root fibres to appear broken up in cats. No such changes have been described for other anæsthetics, and other animals.

(5) Alcohol in small doses does not appear to affect primarily any part of the spinal cord itself.

(6) Secondary degeneration of the ascending columns of the cord had been observed in cats 32 days after alcohol injection. Similar changes have been described following other spinal anæsthetics in dogs.

(7) The effects within the subarachnoid space depend on the different chemical constitution of the solutions used and also on the actual concentration of the solution as it comes

into contact with nerve tissue. Alcohol appears to have a more destructive action on nerve tissue than do the anæsthetic solutions of the cocaine series. Extreme care is necessary in injecting alcohol intra-spinally.

"Avertin anæsthesia in childhood." *Lancet,* January 25th, 1936, p. 209.

Accounts are quoted which show the wide use that is being made of avertin for operations on children in Sweden. The great Children's Hospital, Kronprinsessan Lorisas Vardanstalt, used the drug 1,250 times without mishap and with excellent results up to October 1935. At first used only for exceptional cases, avertin provided such excellent results that it has now been adopted as the standard anæsthetic for children. It is used for all circumcisions, operations for hernia, and for mastoid disease. In many patients with empyema difficult to locate avertin is used for the exploratory punctures as well as for the operation itself. Furthermore, it is stated that avertin solves the problem of the "child under school-age requiring unavoidably painful dental treatment." Tetanus, as in this country, has been treated with avertin.

"Effect on white blood-corpuscles and colloid-kinetic pressure of breathing oxygen-poor and CO_2 rich air." *Tohoku Journ. Experim. Med.,* November 1935, p. 503.

A number of dogs were used for the experiments. The chief results recorded were after an hour of oxygen-poor air:

(1) Blood CO_2 sank and severe acidosis was instituted. The deficient oxygen saturation was increased and the oxygen capacity and haemoglobin content were both diminished.

(2) The general albumen content of the blood increased. The globulin underwent an absolute as well as a relative increase. Albumin, on the contrary, sank.

(3) Colloid-osmotic pressure of the blood fell.

(4) Sinking propensity of erythrocytes tended to be hastened.

After twenty to thirty minutes of breathing of air rich in CO_2 there was found intense increase of blood CO_2; reduction of oxygen saturation-deficiency; reduction of oxygen

capacity and haemoglobin content. The colloid-kinetic pressure of the blood sank. The sinking propensity of the erythrocytes was greatly diminished.

"Teaching anæsthesia service from the viewpoint of surgery." A. M. WRIGHT. Anæs. and Analg., December 1935, p. 246.

It is not often that anæsthetists receive from a surgeon so full an acknowledgment as that to be found in Professor Wright's article, and for that reason we give ourselves the pleasure of quoting his concluding sentence. After alluding to the fine work of M. M. Waters for the Department of Anæsthetics in the University of Wisconsin, Prof. Wright said "The speciality of anæsthesia now holds the promise of becoming the broadest, the best organized, the most scientifically established among clinical fields. The realization of his vision rests in the hands of those who develop and guide departments of anæsthesia in our educational institutions."

"Cardiac failure during anæsthesia." K. BREMER. *S.A. Med. Journ.*, November 9th, 1935, p. 755.

"For total cardiac failure . . . there is no time for any but the one method which has been known to restore the heart's action in many cases, and that is strong rhythmic pressure on the ventricles by means of the fingers of the right hand passed through a rapidly made incision in the upper abdomen." Later, the author writes: "There are only three to six minutes available for re-establishing the circulation. If there is longer delay the heart may still resume its beat, but the patient will probably remain comatose and die within five to forty-eight hours."

Many will disagree with these statements. It is certainly true that life has been restored after a longer interval than six minutes of total cardiac failure, and it would be disastrous in practice if there were to be the early rush to abdominal incision recommended above. At least stimulation of the right auricle by a needle thrust through the chest wall, a trifling procedure that has often stimulated the heart to activity, should be tried first.

"Post-anæsthetic headache." *Archiv. of Surg.* January 1936, p. 99.

The author discusses the causation of headache after endothecal injection, adducing both experimental and clinical evidence in support of his views. More than one factor is involved. The most important he believes to be any irritating nature of the injected solution, and excessive absorption of cerebro-spinal fluid into the blood-stream. By using anæsthetic solutions carefully made up to be as non-irritating as possible, headache is reduced, he claims, almost to the point of disappearance in patients in the recumbent position. Stovaine is, he says, highly irritating. Any acid solution is irritating. A solution which is hypertonic or hypotonic is irritating, and the temperature is important; the injected solution should never be cold. Any solution lacking calcium is irritating. The solution recommended is procaine hydrochloride from 5 to 5.5 per cent. To this calcium chloride is added to make its strength 0.024 per cent. The solution is warmed to body temperature. To overcome excessive absorption of cerebro-spinal fluid four ounces of 5 per cent dextrose are injected directly after operation. This injection is made into a vein. This routine is said to abolish headache almost entirely, even in ambulant patients.

"Ether dosage after premedication." *Journ. Pharmacol. and Exper. Therap.* September 1935, lv, 1, 24–39.

Conclusions curiously at variance with clinical experience were arrived at by experiments on dogs who were given either morphia, barbiturates, or magnesium sulphate before ether inhibition. In all instances it was found that there was no apparent synergism; the blood ether concentrations necessary for surgical anæsthesia and for respiratory arrest were not appreciably lowered. The margin of safety was not affected by these premedications except that it was reduced by magnesium sulphate.

* * * *

The French Society of Anæsthesia and Analgesia, 12 Rue de Seine, Paris, stimulated perhaps by the example of this *Journal*, is offering a prize of 2,000 francs for the best work on anæsthesia or analgesia, which should be sent in before March 31st, 1936. (*B.M.J.*, January 25th, p. 193).

CORRESPONDENCE

THE EMBLEY MEMORIAL LECTURE.

To the Editor the British Journal of Anæsthesia.

Sir,—You were good enough to publish the Embley memorial lecture which I delivered in Melbourne in September last. It has been published in the *Medical Journal of Australia*. I was gratified at the publication of the lecture, but it was accompanied by an editorial expression of opinion against which I have felt it necessary to protest. I would ask if that protest may appear in your *Journal* as it is quite possible that those readers who see the *Medical Journal of Australia* may read the denunciatory leading article there but not the lecture itself. The leading article closes with the following passage:—

> The results of the modern type of cerebral operation speak for themselves. If in the future surgeons are able to evolve newer methods of securing the necessary gentle handling of tissues, asepsis, hæmostasis, and so forth, together with speed, Dr. Mennell's wish will be gratified. This does not at present seem possible. Dr. Mennell comes from London as an anæsthetist of world-wide reputation. His views on anæsthetics and their administration will be listened to with respect. His utterances on cerebral surgery are to be deplored in a country where neuro-surgeons are trying to bring their art to the high level attained in other parts of the world. It is to be hoped that no serious attention will be paid to them.

In support of this contemptuous view the article says:—

> It can be dogmatically stated that the present so-called slow technique has achieved infinitely better results than were obtained by the older methods. To refuse to follow modern methods with a slavish attention to minute detail is to jeopardise the life of the patient. It has been computed that at present the death-rate for

> complete removal of cerebral tumours in Australia, even with the use of modern methods, is somewhere in the region of 80 per cent. Cushing has for certain types of tumour brought his mortality down to as low as 7 per cent. What the death-rate with the old rapid methods was may be left to the imagination. . . . When the operation was performed rapidly, it was the exception rather than the rule for the patient to recover.

Since writing the above I have seen the leading article in *The Lancet* of Feb. 22nd entitled "The Gentle Surgeon," and it appears to me apposite to the remarks made in my Embley lecture and for which I am criticised. Nobody can dispute what is said in that leading article about the surgery in the early part of this century, or that the advance in anæsthesia and the better understanding of shock have enabled surgeons to do without the extreme slashing speed formerly necessary. But surely the pendulum has swung too far, more surgeons relying on the better anæsthesia for a too great deliberateness in their methods. Gentleness and care combined with unflurried speed are the essentials of good surgery.

In reply to the *Medical Journal of Australia* I have made the following protest which they will have received by now, and which I shall be much obliged if you will quote.

I am, Sir, yours faihfully,

Z. MENNELL.

Harley Street, W.
February 21st, 1936.

COPY OF LETTER SENT TO THE EDITOR OF THE MEDICAL JOURNAL OF AUSTRALIA.

Feb. 4th. 1936.

Sir,—Holding the views you have so clearly and forcibly expressed in your leader of Dec. 14th, I feel I must first thank you for your courtesy in giving a verbatim report of the Embley lecture I delivered in Melbourne in September, 1935.

The slides, through an error, have been referred to incorrectly, but notwithstanding the well-known difficulty of reproducing coloured slides, they remain clear enough for anyone reading the paper to realise the mistake.

Your leader is another matter; I wrote the lecture with extreme care, and apart from my personal views I am entitled without giving offence to give reasons why a change in anæsthesia has become necessary in certain cases. No one can be more alive than I am to the fact that there are two schools of thought in intracranial surgery, but I am convinced that speed and gentleness are compatible.

You speak first of all of thoracic surgery. Surely it must be admitted that in this work speed is essential whether the operation is done under a local or general anæsthetic. The most recent lobectomy to which I gave an anæsthetic was done in twenty minutes under a very light chloroform anæsthesia, and the excellent result in this and in other cases in which I have been concerned makes me think that in the future the mortality of this very serious procedure may be lowered by a combination of speed and simple anæsthesia.

I can well understand that when you admit an Australian operative mortality of 80 per cent for the removal of cerebral tumours some change is desirable. Such a mortality is far higher than anything I have met during the thirty-two years I have been giving anæsthesia for such cases. It is because I believe certain neurological surgeons have evolved " the necessary gentle handling of the tissues, asepsis, hæmostasis, and so forth together with speed " that " I cannot understand why it is necessary to be so slow" in making a bone flap, &c. Giving anæsthetics to such cases almost daily, and seeing them afterwards, makes it possible to form the opinion which I felt at liberty to express. I do so more readily as I have had the opportunity of seeing cerebral surgery in the new world and on the continent as well as in England. Are Dandy and Adson, whose skill is recognised throughout the world, slow operators? You will naturally reply to this more " vague and general statements." I have figures, of course, that could be made to prove anything, as they would include many desperate cases and a great variety of tumours.

Here are the figures of four sets of cases.

1. Pituitary tumours operated on by the intracranial route in one year. Twenty-one consecutive cases in 1928 without any untoward symptoms or death. Shortest time forty minutes; longest seventy-five minutes. Neither the late Sir Percy Sargent, who was the surgeon, nor I could claim this a constant figure; but the facts are as stated. Anæsthesia: intratracheal ether with pressure.

2. Gliomata unselected and unclassified. The late Sir Percy Sargent's records, analysed by Mr. Harvey Jackson, who has given me the following data.

Two hundred and sixty successful cerebral gliomata—mortality 12.7 per cent within forty-eight hours.

This is case mortality and not operative mortality, which would be considerably lower.

3. Hedonal anæsthesia. A hundred and twelve cerebral tumours removed reported in the *Transactions* of the Royal Society of Medicine, Section of Anæsthetics, 1922. No death from anæsthetics within twenty-four hours.

4. To illustrate work with which I am concerned in London (if one may venture to cite English experiences in Sydney) I quote one of my last cases (surgeon, Mr. Julian Taylor).

> H. L. 38. Operation Jan. 31st, 1936, for left parietal endothelioma. Anæsthetic started 11.20 a.m. Large bone flap extending across midline. Tumour, weighing 82 grammes, removed. Part of the bone flap taken out which was invaded by the tumour, and then fixed in position. Wound closed and patient in bed 1 p.m. Condition good. Anæsthetic: Atropine, intratracheal N_2O and O_2, ether.
>
> Feb. 2nd: Patient comfortable. Sitting up in bed eating food.
>
> To-day, Feb. 4th: Pulse 76, temperature 97.6°. Patient sitting up apparently without abnormal symptoms.

The use of local anæsthesia and basal narcotics may be the most usual practice in Australia; it is not here. A small quantity of ether added to continuous stream of gas-and-oxygen is believed to be the best after an extensive trial of other methods. I hasten to add pulmonary complications do not occur.

My first expression on reading your leader was surprise, but then it occurred to me how my old friend, Embley, would have risen to the occasion, and I only wish I had his facile pen and power of expression at my command.

I am, Sir, yours faithfully,

Z. MENNELL.

FROM DOWN BROS. LTD.

To The Editor,
British Journal of Anæsthesia.

Sir,—We should be very much obliged if you could insert a short paragraph in your next issue to state that we have been awarded the Medal at the Exhibition in connection with the 10th International Congress of Surgery, Cairo, in December last. . . .

Yours faithfully,
Down Bros. Ltd.

COPY OF ANNOUNCEMENT.

"I have the pleasure to inform you that the Surgical Instruments and Theatre Equipment you exposed at your stand in the Exhibition held in connection with the 10th International Congress of Surgery have been deemed worthy of the Medal of the Exhibition, which I am glad to send you herewith.

"With best regards,
"(*Signed*) Dr. M. Khalil Bay,
"*Secretary-General,*
"Faculty of Medicine,
"Cairo."